A Brief History of Acarology in North Carolina with emphasis on the work of the North Carolina Agricultural Experiment Station

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by

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Several acarological "firsts" occurred in North Carolina. Some of the cattle and most of the ticks which were used by Smith and Kilbourne (1893, Investigations into the nature, causation and prevention of Texas or southern cattle Fever, U. S. Department of Agriculture, Bureau of Animal Industry Bulletin No. 1) in their historic experiments were shipped from New Bern, N. C., on a barge on June 25, 1889. The animals and ticks arrived at the Animal Industry Station near Washington, D. C. two days later. With these ticks and other disease-free cattle, in a series of experiments, the physician and veterinarian were able to show that the ticks could transmit the protozoan which caused the cattle fever. This was an historic breakthrough and is recognized by most authorities as the beginning of medical entomology.

One who was later to become a leader in the eradication of the cattle ticks from North Carolina was listed on the staff of the Agricultural Experiment Station as Professor of Zoology and Veterinary Science for the 1898-99 term. Cooper Curtice later was listed as veterinarian in the Report of the Commissioner of Agriculture for North Carolina for 1900 (the next year). He started North Carolina on its cattle tick eradication program which preceeded the Federal Program by years. He then worked with the Rhode Island Agricultural Experiment Station. In 1906 he was placed in charge of the federal-state

cooperative cattle tick eradication work in North Carolina and Virginia with headquarters in Lynchburg, Virginia (U. S. Department of Agriculture Farmers Bulletin 1057 first dated 1919). Visual inspections, palpitation, arsenical dips, rotation of the cattle on several fields and enforcement of quarantines were the principal means used in eradication. One must not walk too casually in the forests of North Carolina today or he may fall into one of the old concrete dipping vats then used for tick eradication. The original area of distribution of the ticks in North Carolina included the Coastal Plain and most of the Piedmont (Fig. A).

Two other acarological firsts occurred in North Carolina. The first research in the United States concerning the role of mites in forest litter reduction was conducted in the early 1930s at the Bent Creek Forest Experiment Station by Arthur Paul Jacot. He described many oribatids and was a "man ahead of his time" according to George Hepting who knew him and who is now Adjunct Professor of Plant Pathology with North Carolina State University. Also, the first formal course in acarology in the United States was presented by George W. Wharton at Duke University in 1951. I consider myself fortunate to have been in that class of about a dozen students. It was offered during the summer and we worked for 3 weeks from 8:00 in the morning until 8:00 at night and more usually 10:00, except for Sunday morning. Wharton encouraged me to undertake a revision of the Veigaiidae which was published as Technical Bulletin 124 of this Station.

In 1891 Gerald McCarthy, who had been previously listed as botanist with the Station, was listed as botanist and acting entomologist. The

next year he was listed as entomologist. His authorship, in 1891, of North Carolina Agricultural Experiment Station Bulletin no. 78 entitled "Some injurious insects", was ample justification for the change in his title. In it, the first known reference is made to a mite in any station publication. Both plant lice and red spider (Tetranychus telarius) were said to be called "lice" by the cotton growers. Remedies listed were kerosene emulsion, carbolic acid emulsion, tobacco decoction, and potash soap in water. Emphasis was placed on spraying the under sides of the leaves with enough force to break through the webs and strike the pests. This principal is no less important today.

In 1894, in North Carolina Agricultural Experiment Station Bulletin 100 entitled "Our common insects," McCarthy mentions the plant growers' problems with red spiders, the itch mites of man, dogs and other animals, parasitic mites of birds, bats and poultry, and the ticks transmitting Texas fever.

Mite control in the North Carolina Agricultural Experiment Station has always been decentralized and under the auspices of the entomologists or veterinarians working on the various commodity groups. Concern for possible differences in species were not emphasized until recent times.

Bentley B. Fulton probably dealt with as many mite control problems as anyone ever working for the Station. His patience well adapted him for counting many small things. He instructed me how to differentiate sexes of the spider mites on strawberry by their shape and habits, using a stereoscope. The males were "more nervous," and had longer legs in proportion to the body, were lighter in color and had a more pointed abdomen.

Fulton's discovery that doubling the amount of water with the same amount of active ingredient per acre would give better control of spider mites on strawberries has gone largely unrecognized. He attributed this increase in effectiveness simply to more thorough coverage - especially under the leaves.

Fulton also attempted to evaluate superior-type oil sprays against the blueberry bud mite in the dormant season. The small size of this mite and its erratic and spotty infestation on blueberries were sources of variability that plagued him as well as others who have followed, including H. H. Nuenzig and myself.

Fulton also worked on mites infesting country hams in the curing rooms. Fumigants that were available were tried. However, without strict sanitation practices, fumigation alone proved unsatisfactory.

With the increased use of DDT on the apple trees in North Carolina following WW II, came the problem of the European red mite. Predators not killed with lead arsenate, which was formerly used, were killed by DDT and the populations of European red mite would often explode in mid-season and injure the foliage too soon before harvest.

As a graduate student, working with George F. Turnipseed, I found an entirely different phytophagous mite fauna on foliage and trunk bark of unsprayed apple trees compared to those under the spray program. The predatory mites and thrips were more abundant on unsprayed trees too. George Rock and Ray Yeargin were later to confirm these observations in more detail.

On cotton, Walter J. Mistric believed he could differentiate injury by different species of spider mites. Determination of the species,

using the compound microscope, indicated he was largely correct. His encouragement lead to the brief survey of the species and their geographic distribution of spider mites on the cotton crop in North Carolina in 1955 (Fig. B). We concluded there could be several species of mites on cotton plants during the season and that there was the possibility of a change in species with the application of an acaricide. Clyde F. Smith and myself, a few years earlier, had observed this change in phytophagous species present following the application of acaricides to azaleas and reported it at a meeting of the Southern Agricultural Workers. With the transfer of Mistric from cotton to tobacco, interest in spider mites on cotton has appeared to wane, perhaps again because of the decreased use of DDT.

In more recent times, control of spider mites on peanuts has been persued by William V. Campbell, those on apple trees by George Rock and Ray Yeargin and on cotton by the pest management group. Ray Yeargin, working with Rock and myself, have prepared a "checkerboard key" to the phytoseid mites he collected from apple trees while he had been doing work with another emphasis. David Stephan has taken over the routine identifications of mites and occasionally he asks for some help in areas unfamiliar to him or with a particularly difficult decision.

With my joint appointment with the School of Forestry in 1961, and the responsibility for teaching four or more courses, time that could be devoted to research was reduced. The assumption at that time also of the responsibility for the direction of graduate students in forest entomology further reduced the time available for personal research but increased the overall research production which needed to be supervised.

It was obvious at that time, that one principal objective must be to influence others "to work for me."

Now, some 600 undergraduates are well enough trained so that they will not allow insects attacking trees under their supervision to make fools of them as foresters. Most anywhere I go in the state, former students are available and more important very willing to cooperate in any field research.

Six graduate students have completed advanced degrees with me (2 PhD's, 3 MS, and 1 MF) and two are in training (1 PhD, 1 MS). Of these, two have worked on the taxonomy of mites. In both instances, the mites were associated with insects of economic importance - the bark beetles attacking pines in southeastern United States and the imported fire ant, also a problem in southeastern United States. One of these graduate students, James R. McGraw, was recognized as making the Outstanding Contribution for 1970 by the Southern Forest Insect Work Conference. Technical Bulletin 192 of this Station was paid that recognition. Three other students have completed theses on Acarina at North Carolina State (two with Clyde F. Smith and one with H. H. Neunzig). Two graduate students are currently working on the biology and control of spruce spider mite on Fraser fir Christmas trees under the direction of Fred Hain.

Dr. Harvey L. Thomas
Dr. Maurice H. Farrier

Dr James R. Baker

In 1961, with both time and funds limited, and only one semester every two years (including summer sessions) without teaching responsibilities, it also became obvious that I must ally with an on-going research program or little progress could be made. Louis J. Metz, Soil Scientist at the Forestry Science Laboratory, needed taxonomic support in his work with mites in the forest litter. Since 1961, we have cooperated in such work with only a "gentleman's agreement" and no exchange

of funds. We have been able to determine differences in species complexes of mites in the forest litter between mixed hardwood and pine stands and between pine stands in Umstead Park and Duke Forest. Also, working at the Santee Experimental Forest near Charleston, S. C., where experimental plots had been kept for 20 years, we found that prescribed burning (not wildfire) in the forest does not significantly reduce the mesofaunal (small arthropod) populations in the litter if not burned more often than every 5 years. Present forestry practices in southeastern United States are to burn under specific meterological conditions (prescribed burning) and not more often than every 4 or 5 years. Yearly burns did reduce the mesofaunal populations to such a point below those plots not burned that there is concern that these animals may not be abundant enough to be able to function in releasing the nutrients from the litter to the soil (Metz and Farrier, 1973. Prescribed burning and populations of soil mesofauna, Environmental Entomology 2:433-40). Jointly, with S. B. Hill, in Canada, we published a literature review on silvicultural practices affecting the mesofauna in forest litter (Hill, et al., 1975. Soil mesofauna and silvicultural practices in Bernier and Winget, 1975. Forest Soils and Forest Land Management. Les Presses de l'Université Laval, Québec, Canada).

Such ecological work leaves many specimens of undescribed species which need to be described in the future. Keeping up with the literature and having the literature assembled and accessable will continue to be an important future function of the project so that when others come for information on mites and ticks they may be informed with a minimum of delay. Such information enabled us, after a few weeks at the microscope, and translating from the German, to identify the acarid mites

associated with peanut pod rot. It also enabled the graduate student in Plant Pathology to rear the mites and to confidently recognize stages and other species. He could then proceed independently with the main objective of his research. Such policy of being available with literature and advice concerning mites and ticks and means of controlling them will continue to be of high priority in the future. Most all research will continue to be of a cooperative nature with those who seek information on mites. This seems the only prudent course of action with the limited time and funds available.

— Paper almost completed on a list of mites on sprayed and unsprayed apple trees in N.C.

— Micou M. Browne is working on ectoparasites mites & lice of storm petrels.

— Le Roy S Boykin is working on spider mites on peanuts and their ~~an~~ web-spinning habits.

— Rich Brandenburg is working on spider mites on corn and vegetables and separation of species using SEM.

— Jan '79 MF.

Diseases of Cattle. Plate XLIX.

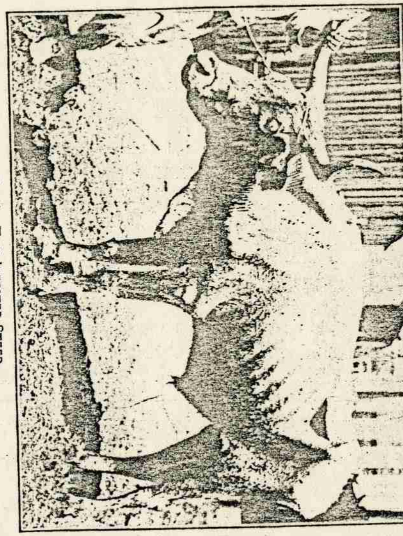


Fig. 1.—Tick-Infested Steer.

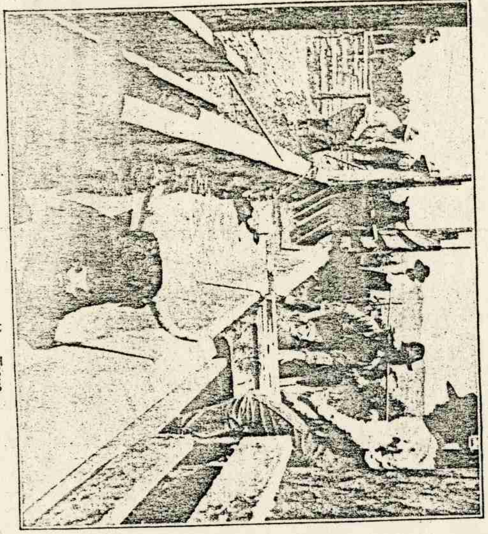
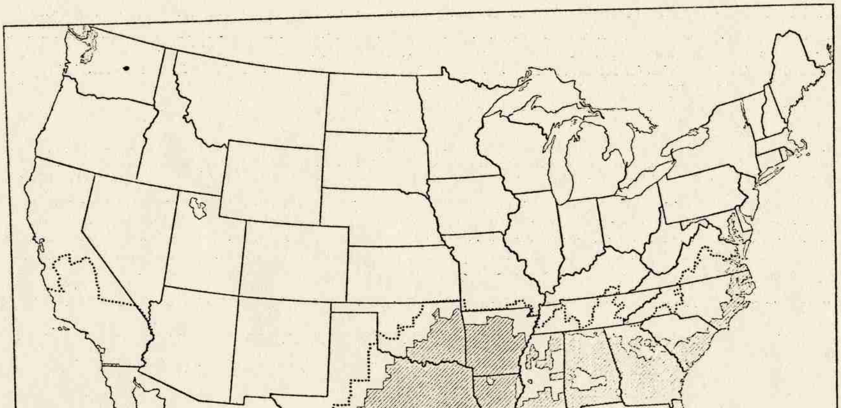


Fig. 2.—Dipping Cattle to Kill Ticks.

Diseases of Cattle. Plate L.



Map of the United States Showing Region Infected with Texas Fever of Cattle.

The heavy dotted line shows the boundary of the tick-infested area at the beginning of the work of tick eradication in 1906. White areas below the line show territory which has been freed from ticks and released from quarantine. Shaded areas remain tick infested and under quarantine (Apr. 1, 1916). The quarantined area is subject to change at any time.

Figure A. (From Mohler, 1916).

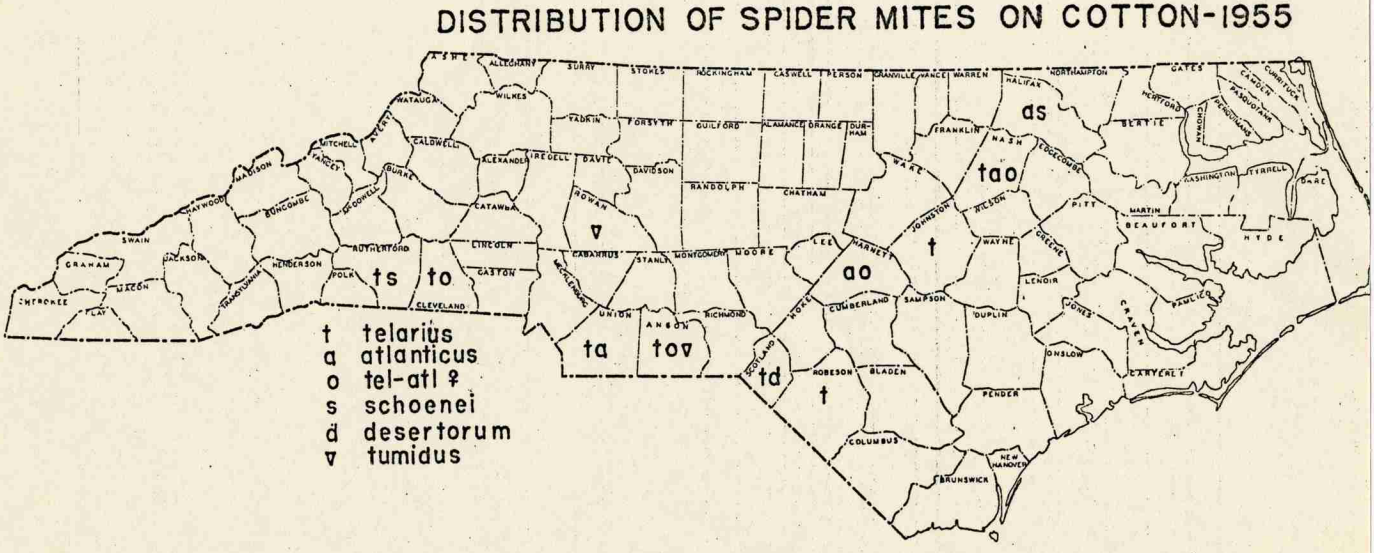


Figure B. Original data presented at Southern Agricultural Workers Conference, Atlanta, January 1956.